

CLAIMS

What is claimed is:

- 1 1. A computer-readable medium carrying one or more sequences of instructions for
2 authorizing a data communication session between a client and a first server,
3 wherein execution of the one or more sequences of instructions by one or more
4 processors causes the one or more processors to perform the steps of:
5 receiving a request to establish the session, wherein the request is associated with
6 a particular entity that is associated with the client;
7 determining whether authorization of the session can be performed locally at a
8 second server;
9 if authorization of the session can be performed locally at the second server, then
10 informing the first server that the session may be established between the
11 client and the first server for the particular entity;
12 and after informing the first server, informing a third server that is
13 associated with the particular entity that the session has been
14 authorized to be established for the particular entity.
- 1 2. The computer-readable medium of claim 1 wherein execution of the one or more
2 sequences of instructions by one or more processors causes the one or more
3 processors to perform the steps of:
4 if authorization of the session cannot be performed locally at the second server,
5 then,
6 requesting the third server to authorize the session between the client and
7 the first server; and
8 informing the first server, based on a response received from the third
9 server, whether the session may be authorized.

1 3. The computer-readable medium of claim 1 wherein execution of the one or more
2 sequences of instructions by one or more processors causes the one or more
3 processors to perform the step of determining whether authorization of the session
4 can be performed locally at the second server by performing the steps of:
5 determining a session counter value, wherein the session counter value indicates
6 the number of sessions that are currently active for the particular entity;
7 determining a session threshold value, wherein the session threshold value
8 indicates a threshold as to a number of sessions that may be currently
9 active before sessions cannot be authorized locally by the second server;
10 and
11 comparing the session counter value with the session threshold value to determine
12 whether authorization of the session can be performed locally at the
13 second server.

1 4. The computer-readable medium of claim 1 wherein execution of the one or more
2 sequences of instructions by one or more processors causes the one or more
3 processors to perform the step of determining whether authorization of the session
4 can be performed locally at the second server by performing the step of:
5 determining whether the second server has received a prior request for the
6 particular entity.

1 5. The computer-readable medium of claim 1 wherein execution of the one or more
2 sequences of instructions by one or more processors causes the one or more
3 processors to perform the step of:
4 prior to receiving the request, maintaining data that is associated
5 with the second server, wherein the data includes,

6 a session counter value, wherein the session counter value indicates the
7 number of sessions that are currently active for the particular
8 entity; and
9 a session threshold value, wherein the session threshold value indicates a
10 particular number of sessions that may be currently active before
11 sessions cannot be authorized locally by the second server.

1 6. The computer-readable medium of claim 5 wherein execution of the one or more
2 sequences of instructions by one or more processors causes the one or more
3 processors to perform the step of maintaining data that is associated with the
4 second server by performing the step of:
5 maintaining a server identifier, wherein the server identifier identifies a particular
6 server that is assigned to the particular entity.

1 7. The computer-readable medium of claim 1 wherein execution of the one or more
2 sequences of instructions by one or more processors causes the one or more
3 processors to perform the step of receiving the request to establish the session by
4 performing the step of:
5 receiving a connection request, wherein the connection request requests
6 authorization to establish a Point-to-Point Protocol connection between the
7 client and the first server.

8 8. The computer-readable medium of claim 1 wherein execution of the one or more
9 sequences of instructions by one or more processors causes the one or more
10 processors to perform the step of:
11 identifying the third server by retrieving global data, wherein the global data maps
12 a particular server to each of one or more entities.

1 9. The computer-readable medium of claim 1 wherein execution of the one or more
2 sequences of instructions by one or more processors causes the one or more
3 processors to perform the step of:
4 identifying the third server by retrieving a server identifier, wherein the server
5 identifier identifies a particular server that is assigned to the particular
6 entity.

1 10. The computer-readable medium of claim 1 wherein execution of the one or more
2 sequences of instructions by one or more processors causes the one or more
3 processors to perform the step of informing the third server by performing the
4 steps of:
5 determining, at the third server, whether other servers have previously authorized
6 sessions for the particular entity; and
7 if other servers have previously authorized sessions for the particular entity, then
8 informing the other servers that the session has been authorized for the
9 particular entity.

1 11. The computer-readable medium of claim 10 wherein execution of the one or more
2 sequences of instructions by one or more processors causes the one or more
3 processors to perform the steps of:
4 prior to informing the other servers,
5 maintaining session counter values at each of the other servers, wherein
6 the session counter values indicate the number of sessions that are
7 currently active for the particular entity; and
8 after being informed that the session has been authorized for the particular entity,
9 updating the session counter values at each of the other servers to reflect
10 that the session has been authorized for the particular entity.

1 12. The computer-readable medium of claim 1, wherein the request to establish a
2 session is encrypted to maintain a secure communication, and wherein execution
3 of the one or more sequences of instructions by one or more processors causes the
4 one or more processors to perform the steps of receiving the request based on the
5 encrypted request.

1 13. The computer-readable medium of claim 1, wherein execution of the one or more
2 sequences of instructions by one or more processors causes the one or more
3 processors to perform the step of informing the first server by informing with an
4 encrypted communication.

1 14. The computer-readable medium of claim 1, wherein execution of the one or more
2 sequences of instructions by one or more processors causes the one or more
3 processors to perform the step of informing the third server by informing with an
4 encrypted communication.

1 15. The computer-readable medium of claim 1, wherein execution of the one or more
2 sequences of instructions by one or more processors causes the one or more
3 processors to perform the step of:
4 receiving at the second server a connection termination message indicating that a
5 session that was authorized locally at the second server has terminated.

6 16. The computer-readable medium of claim 15, wherein execution of the one or
7 more sequences of instructions by one or more processors causes the one or more
8 processors to perform the steps of:
9 identifying an authoritative server assigned to the particular entity; and
10 if the second server is identified as the authoritative server for the particular
11 entity, then

12 updating global session information of the second server to reflect
13 termination of the terminated session.

1 17. A computer-readable medium carrying one or more sequences of instructions for
2 broadcasting session information to one or more servers, wherein execution of the
3 one or more sequences of instructions by one or more processors causes the one
4 or more processors to perform the steps of:
5 receiving a message from a first server, wherein the message indicates that a
6 session has been authorized for a particular entity;
7 determining whether one or more other servers have previously authorized
8 sessions for the particular entity; and
9 if one or more other servers have previously authorized sessions for the particular
10 entity, then
11 informing the one or more other servers that another session has been
12 authorized for the particular entity.

1 18. The computer-readable medium of claim 17 wherein execution of the one or more
2 sequences of instructions by one or more processors causes the one or more
3 processors to perform the step of:
4 prior to receiving the message from the first server,
5 maintaining data that is associated with a second server, wherein the data includes
6 a session counter value, wherein the session counter value indicates the
7 number of sessions that are currently active for the particular
8 entity; and
9 a server list, wherein the server list identifies the one or more other servers
10 that have previously authorized sessions for the particular entity.

1 19. A computer-readable medium carrying one or more sequences of instructions for
2 authorizing a data communication session between a client and a server in a
3 network, wherein execution of the one or more sequences of instructions by one
4 or more processors causes the one or more processors to perform the steps of:
5 receiving a connection request at a distributed session counter for authorization to
6 establish a session between the client and the server, wherein the
7 connection request is associated with a particular entity;
8 determining whether authorization of the session can be performed locally at the
9 distributed session counter;
10 if authorization of the session can be performed locally at the distributed session
11 counter, then
12 sending an authorization granted message to the server to indicate that the
13 session may be established between the client and the server for
14 the particular entity;
15 identifying an authoritative distributed session counter that is associated
16 with the particular entity; and
17 after sending the authorization granted message to the server, sending a
18 authorization update message to the authoritative distributed
19 session counter, wherein the authorization update message notifies
20 the authoritative distribution counter that the session has been
21 authorized to be established for the particular entity.

1 20. The computer-readable medium of claim 19 wherein execution of the one or more
2 sequences of instructions by one or more processors causes the one or more
3 processors to perform the steps of:
4 if authorization of the session cannot be performed locally at the distributed
5 session counter, then

6 sending an authorization request message to the authoritative distributed
7 session to request authorization to authorize the session between
8 the client and the server; and
9 sending a response to the server based on a response message that is
10 received from the authoritative distributed session, wherein the
11 response message indicates whether the session should be
12 authorized.

1 21. The computer-readable medium of claim 19, wherein global session threshold
2 values are assigned to indicate thresholds as to a number of sessions that may be
3 concurrently active for each of a plurality of entities, and wherein a particular user
4 is associated with two or more entities of the plurality of entities, and wherein
5 execution of the one or more sequences of instructions by one or more processors
6 causes the one or more processors to perform the step of:
7 for the particular user, determining whether authorization of the session can be
8 performed, by,
9 for each of the two or more entities, comparing the global threshold value
10 with the number of active sessions for the corresponding entity;
11 and
12 if the number of active sessions for any of the entities is greater or equal to
13 the corresponding global threshold value, then denying
14 authorization of the session.

1 22. The computer-readable medium of claim 19 wherein execution of the one or more
2 sequences of instructions by one or more processors causes the one or more
3 processors to perform the step of determining whether authorization of the session
4 can be performed locally at the distributed session counter by performing the
5 steps of:

6 determining a local session counter value, wherein the local session counter value
7 indicates the number of sessions that are currently active for the particular
8 entity;
9 determining a local session threshold value, wherein the local session threshold
10 value indicates a threshold as to a number of sessions that may be
11 currently active before sessions cannot be authorized locally by the
12 distributed session counter; and
13 comparing the local session counter value with the local session threshold value to
14 determine whether authorization of the session can be performed locally at
15 the distributed session counter.

1 23. The computer-readable medium of claim 19, wherein execution of the one or
2 more sequences of instructions by one or more processors causes the one or more
3 processors to perform the step of:
4 maintaining distributed session information, wherein the distributed session
5 information includes over-subscription information that identifies for the
6 distributed session counter the number of times that the number of
7 sessions established for a particular user or group of users was greater than
8 the number authorized.

9 24. The computer-readable medium of claim 19 wherein execution of the one or more
10 sequences of instructions by one or more processors causes the one or more
11 processors to perform the step of determining whether authorization of the session
12 can be performed locally at the distributed session counter by performing the step
13 of:
14 determining whether the distributed session counter has received a prior
15 connection request for the particular entity.

1 25. The computer-readable medium of claim 19 wherein execution of the one or more
2 sequences of instructions by one or more processors causes the one or more
3 processors to perform the step of:
4 prior to receiving the connection request,
5 maintaining a connection data storage area, wherein the connection data
6 storage area includes
7 a local session counter value, wherein the local session counter
8 value indicates the number of sessions that are currently
9 active for the particular entity; and
10 a local session threshold value, wherein the local session threshold
11 value indicates a particular number of sessions that may be
12 currently active before sessions cannot be authorized
13 locally by the distributed session counter.

1 26. The computer-readable medium of claim 25 wherein execution of the one or more
2 sequences of instructions by one or more processors causes the one or more
3 processors to perform the step of maintaining the connection data storage area by
4 performing the step of:
5 maintaining an authoritative distributed session counter identifier, wherein the
6 authoritative distributed session counter identifier identifies a particular
7 authoritative distributed session counter that is assigned to the particular
8 entity.

1 27. The computer-readable medium of claim 19 wherein execution of the one or more
2 sequences of instructions by one or more processors causes the one or more
3 processors to perform the step of identifying the authoritative distributed session
4 counter by performing the step of:

5 interfacing with a global storage area, wherein the global storage area maps a
6 particular authoritative distributed session counter to each entity.

1 28. The computer-readable medium of claim 19 wherein execution of the one or more
2 sequences of instructions by one or more processors causes the one or more
3 processors to perform the step of identifying the authoritative distributed session
4 counter by performing the step of:
5 retrieving an authoritative distributed session counter identifier, wherein the
6 authoritative distributed session counter identifier identifies the
7 authoritative distributed session counter that is assigned to the particular
8 entity.

1 29. The computer-readable medium of claim 19 wherein execution of the one or more
2 sequences of instructions by one or more processors causes the one or more
3 processors to perform the step of sending the authorization update message to the
4 authoritative distributed session counter by performing the steps of:
5 determining, by the authoritative distributed session counter, whether other
6 distributed session counters have previously authorized sessions for the
7 particular entity; and
8 if other distributed session counters have previously authorized sessions for the
9 particular entity, then broadcasting an update message to the other
10 distributed session counters to indicate that another session has been
11 authorized for the particular entity.

1 30. The computer-readable medium of claim 29 wherein execution of the one or more
2 sequences of instructions by one or more processors causes the one or more
3 processors to perform the steps of:
4 prior to the other distributed session counters receiving the update message,
5 maintaining a local session counter value at each of the other distributed
6 session counters, wherein the local session counter value indicates

7 the number of sessions that are currently active for the particular
8 entity; and
9 after receiving the update message,
10 updating the local session counter value at each of the other distributed
11 session counters based on the update message.

1 31. The computer-readable medium of claim 19, wherein execution of the one or
2 more sequences of instructions by one or more processors causes the one or more
3 processors to perform the steps of receiving the connection request, sending an
4 authorization granted message, and sending an authorization update message with
5 an encrypted communication.

1 32. The computer-readable medium of claim 19, wherein execution of the one or
2 more sequences of instructions by one or more processors causes the one or more
3 processors to perform the step of:
4 maintaining distributed session information, wherein the distributed session
5 information includes connection identity information that identifies for the
6 distributed session counter the server and associated port used to establish
7 the session.

1 33. The computer-readable medium of claim 19, wherein execution of the one or
2 more sequences of instructions by one or more processors causes the one or more
3 processors to perform the steps of:
4 receiving at the distributed session counter a connection termination message
5 indicating that a session that was authorized locally at the distributed
6 session counter has terminated;
7 if the distributed session counter was identified as the authoritative distributed
8 session counter for the particular entity, then

9 updating global session information of the distributed session counter to
10 reflect termination of the terminated session;
11 identifying other distributed session counters that have sent an
12 authorization request for the particular entity; and
13 broadcasting a session termination message to the other distributed session
14 counters indicating that the session has terminated.

1 34. The computer-readable medium of claim 33, wherein execution of the one or
2 more sequences of instructions by one or more processors causes the one or more
3 processors to perform the steps of:
4 if the distributed session counter was not identified as the authoritative distributed
5 session counter for the particular entity, then
6 sending a session termination message to the authoritative distributed
7 session counter indicating that the session has terminated.

1 35. A computer-readable medium carrying one or more sequences of instructions for
2 broadcasting session update information to distributed session counters, wherein
3 execution of the one or more sequences of instructions by one or more processors
4 causes the one or more processors to perform the steps of:
5 receiving an authorization update message from a distributed session counter,
6 wherein the authorization update message indicates that a session has been
7 authorized for a particular entity;
8 determining whether other distributed session counters have previously authorized
9 sessions for the particular entity; and
10 if other distributed session counters have previously authorized sessions for the
11 particular entity, then broadcasting an update message to the other
12 distributed session counters, wherein the update message notifies the other

13 distributed session counters that another session has been authorized for
14 the particular entity.

1 36. The computer-readable medium of claim 35 wherein execution of the one or more
2 sequences of instructions by one or more processors causes the one or more
3 processors to perform the steps of:
4 prior to receiving the authorization update message,
5 maintaining a connection data storage area, wherein the connection data storage
6 area includes
7 a global session counter value, wherein the global session counter value
8 indicates a global value of the number of sessions that are currently
9 active for the particular entity; and
10 a local distributed session counter list, wherein the local distributed
11 session counter list identifies the other distributed session counters
12 that have previously authorized sessions for the particular entity.

1 37. A computer apparatus comprising:
2 a processor; and
3 a memory coupled to the processor, the memory containing one or more
4 sequences of instructions for authorizing a data communication session
5 between a client and a server in a network, wherein execution of the one
6 or more sequences of instructions by the processor causes the processor to
7 perform the steps of:
8 receiving a connection request at a distributed session counter for
9 authorization to establish a session between the client and the
10 server, wherein the connection request is associated with a
11 particular entity;

12 determining whether authorization of the session can be performed locally
13 at the distributed session counter;
14 if authorization of the session can be performed locally at the distributed
15 session counter, then
16 sending an authorization granted message to the server to indicate
17 that the session may be established between the client and
18 the server for the particular entity;
19 identifying an authoritative distributed session counter that is
20 associated with the particular entity; and
21 after sending the authorization granted message to the server,
22 sending a authorization update message to the authoritative
23 distributed session counter, wherein the authorization
24 update message notifies the authoritative distribution
25 counter that the session has been authorized to be
26 established for the particular entity.

1 38. The computer apparatus of claim 37, wherein execution of the one or more
2 sequences of instructions by the processor causes the processor to perform the
3 steps of:
4 if authorization of the session cannot be performed locally at the distributed
5 session counter, then
6 sending an authorization request message to the authoritative distributed
7 session to request authorization to authorize the session between
8 the client and the server; and
9 sending a response to the server based on a response message that is
10 received from the authoritative distributed session, wherein the

11 response message indicates whether the session should be
12 authorized.

1 39. The computer apparatus of claim 37, wherein execution of the one or more
2 sequences of instructions by the processor causes the processor to perform the
3 steps of determining whether authorization of the session can be performed
4 locally at the distributed session counter by performing the steps of:
5 determining a local session counter value, wherein the local session counter value
6 indicates the number of sessions that are currently active for the particular
7 entity;
8 determining a local session threshold value, wherein the local session threshold
9 value indicates a threshold as to a number of sessions that may be
10 currently active before sessions cannot be authorized locally by the
11 distributed session counter; and
12 comparing the local session counter value with the local session threshold value to
13 determine whether authorization of the session can be performed locally at
14 the distributed session counter.

1 40. The computer apparatus of claim 37, wherein execution of the one or more
2 sequences of instructions by the processor causes the processor to perform the
3 steps of:
4 prior to receiving the connection request,
5 maintaining a connection data storage area, wherein the connection data
6 storage area includes
7 a local session counter value, wherein the local session counter
8 value indicates the number of sessions that are currently
9 active for the particular entity; and

10 a local session threshold value, wherein the local session threshold
11 value indicates a particular number of sessions that may be
12 currently active before sessions cannot be authorized
13 locally by the distributed session counter.

1 41. The computer apparatus of claim 37, wherein the distributed session counter is
2 constituent to an Authentication, Authorization, and Accounting server.

1 42. A computer apparatus comprising:
2 a processor; and
3 a memory coupled to the processor, the memory containing one or more
4 sequences of instructions for broadcasting session update information to
5 distributed session counters, wherein execution of the one or more
6 sequences of instructions by the processor causes the processor to perform
7 the steps of:
8 receiving an authorization update message from a distributed session
9 counter, wherein the authorization update message indicates that a
10 session has been authorized for a particular entity;
11 determining whether other distributed session counters have previously
12 authorized sessions for the particular entity; and
13 if other distributed session counters have previously authorized sessions
14 for the particular entity, then broadcasting an update message to
15 the other distributed session counters, wherein the update message
16 notifies the other distributed session counters that another session
17 has been authorized for the particular entity.

1 43. An apparatus for authorizing a data communication session between a client and a
2 first server, the apparatus comprising:

3 means for receiving a request to establish the session, wherein the request is
4 associated with a particular entity that is associated with the client;
5 means for determining whether authorization of the session can be performed
6 locally at a second server;
7 if authorization of the session can be performed locally at the second server, then
8 means for informing the first server that the session may be established
9 between the client and the first server for the particular entity; and
10 means for informing a third server that is associated with the particular
11 entity that the session has been authorized to be established for the
12 particular entity after informing the first server.

1 44. An apparatus for broadcasting session information to one or more servers, the
2 apparatus comprising:
3 means for receiving a message from a first server, wherein the message indicates
4 that a session has been authorized for a particular entity;
5 means for determining whether one or more other servers have previously
6 authorized sessions for the particular entity; and
7 if one or more other servers have previously authorized sessions for the particular
8 entity, then means for informing the one or more other servers that another
9 session has been authorized for the particular entity.

1 45. An apparatus for authorizing a data communication session between a client and a
2 server in a network, the apparatus comprising:
3 means for receiving a connection request at a distributed session counter for
4 authorization to establish a session between the client and the server,
5 wherein the connection request is associated with a particular entity;
6 means for determining whether authorization of the session can be performed
7 locally at the distributed session counter;

8 if authorization of the session can be performed locally at the distributed session
9 counter, then
10 means for sending an authorization granted message to the server to
11 indicate that the session may be established between the client and
12 the server for the particular entity;
13 means for identifying an authoritative distributed session counter that is
14 associated with the particular entity; and
15 means for sending a authorization update message to the authoritative
16 distributed session counter, wherein the authorization update
17 message notifies the authoritative distribution counter that the
18 session has been authorized to be established for the particular
19 entity after sending the authorization granted message to the
20 server.

1 46. An apparatus for broadcasting session update information to distributed session
2 counters, the apparatus comprising:
3 means for receiving an authorization update message from a distributed session
4 counter, wherein the authorization update message indicates that a session
5 has been authorized for a particular entity;
6 means for determining whether other distributed session counters have previously
7 authorized sessions for the particular entity; and
8 if other distributed session counters have previously authorized sessions for the
9 particular entity, then
10 means for broadcasting an update message to the other distributed session
11 counters, wherein the update message notifies the other distributed
12 session counters that another session has been authorized for the
13 particular entity.